mander employs and manages during a tactical operation. To ensure that these platoons are combat ready, the platoon EXEVALs must be recognized as a priority event on the yearly training schedule.

It is absolutely essential that the event be scheduled at a logical point in the course of the yearly training program, and that the battalion commander, S-3, and company commanders recognize the need for allocating preparation time well in advance of the event. While the train-up period for the evaluators may represent a short term inconvenience to a company or a staff section, it represents a long term investment to the battalion.

The platoon EXEVALs should not be an isolated training event. They should reflect the unit's METL and be closely linked to other highlights of the yearly training program. Moreover, the EXEVAL results must be effectively captured during timely after action reviews, and in writing, and must ultimately be used to plan and guide future training.

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Infantry Mortar Hipshoot

LIEUTENANT SEAN M. O'BRIEN

In recent years the U.S. Army has developed the M23 mortar ballistic computer (MBC). The intent behind its development was to enable infantry mortars to provide more accurate and timely indirect fires and, essentially, the Army has achieved this goal. However, the MBC is no better to use than the plotting board for hipshoot missions, because it takes roughly the same amount of time to put all the set-up data into the computer as to use the plotting board.

Unfortunately, plotting board skills have deteriorated because many soldiers have chosen to rely exclusively on the computer, little realizing that the computer can fail at any time for any number of reasons and they will then have to use the plotting board.

Admittedly, using the school-taught technique on the plotting board, a hipshot does take a considerable amount of time and computational skill. When computing the data, for example, a leader must first fumble with his map and protractor to determine the direction and distance to the target. The time required to complete this task varies with the leader's navigation skills. He then uses three to four more minutes to set up the board, and probably another 30 to 60 seconds to compute the data.

The accuracy of this technique is also somewhat questionable. For example, given a map, a protractor, and two grids, ten people are likely to give you ten different directions and distances to a target. But looking at the map and plotting board as two-dimensional graphs with X and Y axes intersecting, a leader can produce more responsive and accurate data.

During a field training exercise, the mortar platoon of the 2d Battalion, 27th Infantry at Fort Ord used the following technique with consistently outstanding results. It is easy to understand and compute, and it offers other advantages as well. The direction and the distance are found mathematically—thus eliminating the guesswork associated with the old plotting board technique of using a map, a protractor, and a bar scale—and it is faster and more accurate.

With this technique, a round is enroute to the target in one and one-half to two minutes, while the soldier using the older technique is still computing data. (Remember, the mission of the infantry mortar is primarily to suppress, not to destroy. It is, therefore, crucial to have the most responsive indirect fire system possible.) Another advantage is that, because the direction and distance are known so quickly, the charge book or whiz wheel can be used immediately. It also helps in determining whether or not to use the pivot point of the board to represent the mortar position.

In addition, the method is easy to teach. New soldiers pick it up very quickly, which means all the members of a squad, section, or platoon can compute and fire a hipshot. And because it is so much easier than the school-taught method, squad leaders are more likely to use the plotting board than the MBC for a hipshoot mission. Tactically, this technique increases a mortar platoon's survivability, because it allows gun squads to operate more efficiently and effectively as independent elements.

To understand the concept behind the

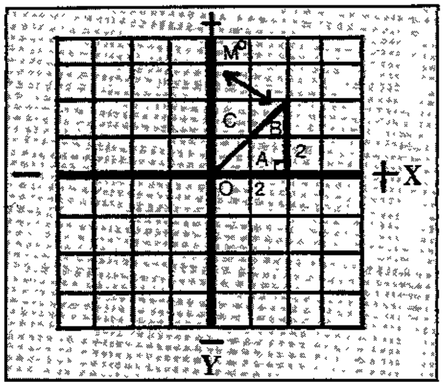

Figure 1

technique, recall the Pythagorean theorem, which states that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides, or $A^2 + B^2 = C^2$.

Start with a graph of X and Y (Figure 1). With X being the horizontal axis and Y being the vertical, at the intersection, X = 0 and Y = 0, normally written (0,0). X decreases to the left of 0 and increases to the right; Y decreases downward and increases upward. Imagine the mortar location at (0,0) and the target at (2,2), the point where X = 2 and Y = 2. Think of these two locations as grids, and remember that when reading a map, you read to the right (east) and up (north). Grids increase to the right (E) and up (N) and decrease to the left (W) and down (S). X is therefore east and Y is north, and the target is northeast of the mortar location.

Looking at the right triangle formed by these lines, now labeled A, B, and C, and given that A = 2 and B = 2, you can determine the distance from mortar to target by finding the length of C. Using the formula $A^2 + B^2 = C^2$, $4 + 4 = C^2$. $C^2 = 8$ and C = 2.828 (the square root of 8), which is the distance to the target. The angle of fire is taken from the angle M (90 - angle XY = M) or from rotating the disk of the plotting board.

To understand the target direction or location from your mortar position, just remember the following:

- If the easterly grid of the target location is greater than the easterly grid of the mortar position, the target is east.
- If the northerly grid of the target location is greater than the northerly grid of the mortar location, the target is north.
- If the easterly grid of the target location is less than the easterly grid of the mortar location, the target is west.
- If the northerly grid of the target location is less than the northerly grid of the mortar position, the target is south.

To prepare the plotting board for either a 60mm or an 81mm mortar hipshoot mission:

- Determine the gun position.
- Determine the location of the target.
- Convert the gun and target positions to 10-digit grids by adding the appropriate number of zeros. (To ensure that the distances are accurate to one meter, it is necessary to express them as 10-digit grids.)
- Determine the difference between the two grids by subtracting the easterly grid reading for the location of the mortar from the easterly grid reading of the target and the northerly grid reading of the mortar location from the northerly grid reading of the target.

Two examples will illustrate:

In the first (Figure 2), the gun location is easterly 5874 and northerly 8922. Add zeros to get 58740 and 89220. The target location is easterly 6099 and northerly 9155. Add zeros to get 60990 and 91550.

The difference between the easterly grids (60990 - 58740) is 2550. Since the grid for the target location is greater than that of the mortar location, the direction is east.

The difference between the northerly grids (91550 - 89220) is 2330. Since the grid of the target location is greater than

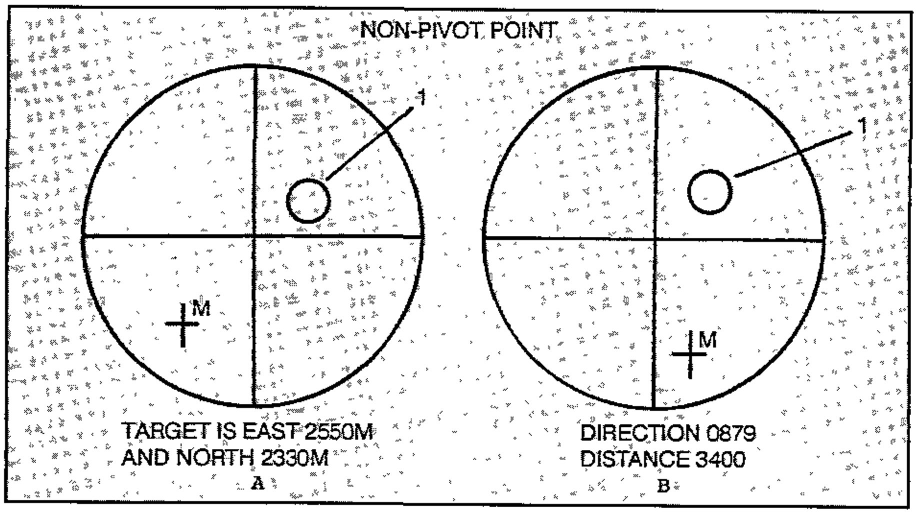

Figure 2

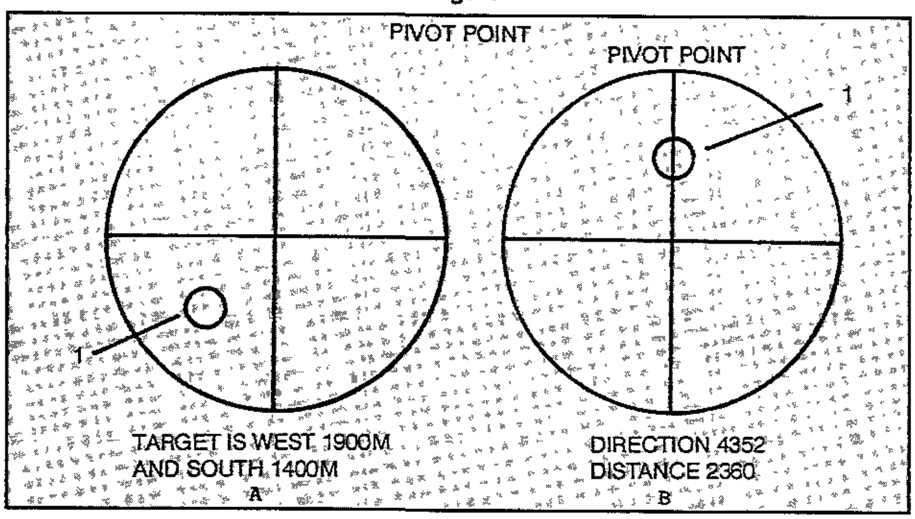

Figure 3

that of the mortar location, the direction is north.

The target is therefore 2550 meters east and 2330 meters north.

In another example (Figure 3), the gun location is easterly 601 and northerly 524. Add zeros to get 60100 and 52400. The target location is easterly 582 and northerly 510. Add zeros to get 58200 and 51000.

The difference between the easterly grids (60100 - 58200) is 1900. Since the grid of the target location is less than that of the mortar location, the direction is west.

The difference between the northerly grids (52400 - 51000) is 1400. Since the grid of the target location is less than that of the mortar location, the direction is south.

The target location is therefore 1900 meters west and 1400 meters south of the mortar position.

Now that you have the information necessary to determine the distance from the mortar position to the target, you can begin computing your gun data.

- Align the zero of the azimuth scale on the rotatable disk with the zero of the green vernier scale, located at the top of the board.
- Select any heavy grid line intersection and mark it with a small plot enclosed with a mortar symbol (see Figures 2-A and 3-A). If your calculations show that you will be moving to the east and north, then start in the opposite quadrant, that is, the southwest portion of the board. The pivot point may also be used.
- From the mortar position plot, move the predetermined direction and distance (each small square has a value of 50 meters and each large square a value of 500 meters).
- Once you have moved the right distance, the ending point becomes the target plot. Circle this plot and mark it with a 1, annotating it as your first plot. If you find that you cannot go the full distance you determined, you will need to go back and move your mortar position so as to allow the target to be plotted.
- To determine the azimuth to the target (Figure 2-B), rotate the disk until the No. 1 plot is aligned with the center vertical grid line or with the mortar position (see Figure 3-B). Always keep the mortar closer to the bottom of the plotting board.
- Once you have determined the direction of fire (DOF), round it off to the nearest 50 mils and it becomes the mounting azimuth (MAZ). Once the MAZ is determined, write (superimpose) the referred deflection under this number.
- Realign the mortar position and the target and determine the deflection. The first two digits of the deflection (DEF) come from the superimposed deflection scale. Remember the LARS rule (left, add; right, subtract); the first two digits are the two numbers that are closest to the 0 of the vernier scale (right side) but does not pass the line. The next (third) number is the number of tick marks that are between the first two digits and the 0 of the vernier scale. The fourth digit is read at the vernier scale. For deflection use the right half of the vernier scale, the first digit is read by starting at the 0 and finding the tick mark on the disk that aligns with one of the tick marks of the vernier scale. The last number of the deflection is the number that coincides with the aligned tick marks.
- To determine the range if using the pivot point as the mortar position, align the plot and simply read the scale for the range. Or lay the edge of the range arm between the mortar position and the target location, aligning the 0 of the range arm with the mortar position, and read the range at the target to the nearest 25 meters. You will soon find, however, that the range arm is not necessary. You can just count the intersecting graph lines.
- The computer receives and applies the observer's corrections. He indexes the observer's direction (which is an azimuth) and places a small triangle under the 0 of the vernier scale at the observer's direction. He then plots the observer's correction from plot No. 1 by moving the number of meters that the observer requests. He marks this plot by circling it and annotating it as No. 2.
- To determine the new deflection, he simply aligns the mortar position and the No. 2 plot and reads the deflection. Then he measures the range with the range arm. (If he is using the pivot point for the mortar position, he simply aligns the plot and reads the range.)
- To add other targets, known points, and reference points (RPs), he uses the same process as the original target plotting method.
- To determine the Angle T, he simply finds the difference between the DOF and the observer's direction.

Because the direction and distance is obtained by a more precise technique, it is important to add that the standards for performing this task should reflect that precision. Accordingly, as a result of developing and using this hipshoot technique, we recommend the following standards of performance:

- Determine direction of fire without error (0 mils).
- Determine mounting azimuth without error.
- Superimpose referred deflection that corresponds to the mounting azimuth.
- Complete computing the mission within two minutes.
- Plot all additional known points, targets, and RPs without error.

I currently use this technique with my soldiers in the 7th Infantry Division, and I have used it on a live fire exercise. Its testimony to accuracy is that mission after mission, little adjustment was required to move the round to a direct hit. On most occasions, both the 81mm mortar squad leaders and the 60mm mortar section sergeants achieved first round suppression with their respective weapon systems. Because I firmly believe that we should train the way we plan to fight, I will continue using this technique and these standards of performance.

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